FC4150Fxx Product Brief

[FC4150F512, FC4150F2M, FC4150F1M_A, FC4150F1M_B]

The FC4150F512, FC4150F2M, FC4150F1M_A, and FC4150F1M_B constitute the FC4150 family of microcontrollers with diverse memory sizes, packages, and peripherals for design scalability.

The FC4150 product series builds on the Arm® Cortex®-M4F core to deliver high-performance 32-bit computing for cost-sensitive and low-power automotive applications. The FC4150 family offers a broad range of options for you to choose from.

Key Features

- 32-bit ARM® Cortex®-M4F core
- Up to 150 MHz execution speed
- Up to 2 MB PFlash, 256 KB DFlash, and 256 KB RAM
- Temp Grade1/-40°C to +125°C
- ISO 26262 ASIL-B support
- Package: LQFP-64, -100, -144, -176-EP
- AEC-Q100

Target Applications

- Body Control Module (BCM)
- Door
- Seat
- Window
- Power Tail Gate (PTG)
- Ambient lighting
- On-Board Charger (OBC)
- Motor control
- P-Box
- Airbag
- Heating, Ventilation, and Air Conditioning (HVAC)
- T-Box
- Camera Monitor System (CMS)
- 48V Battery Management System (BMS)
- Thermal Management System (TMS)
- Anti-lock Brake System (ABS)

1 Block Diagrams

The following figures show the block diagrams of the FC4150 family. For a detailed comparison, refer to *Table 1. FC4150 feature list*.

Figure 1. FC4150F2M block diagram

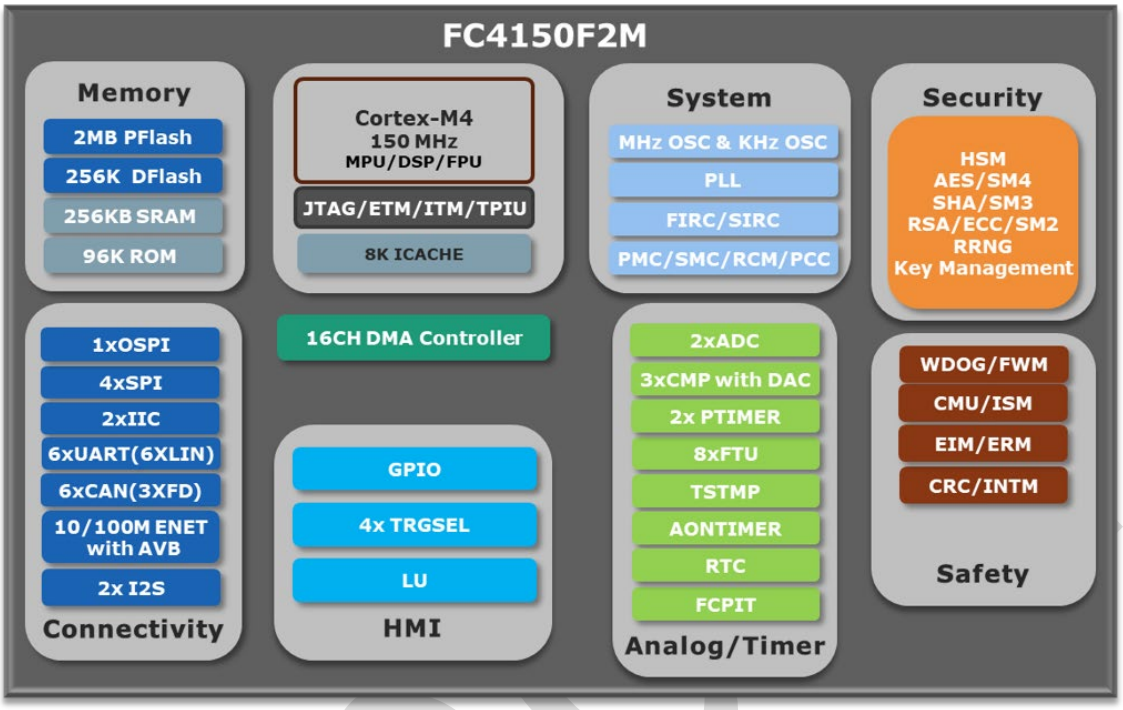


Figure 2. FC4150F1M_A block diagram

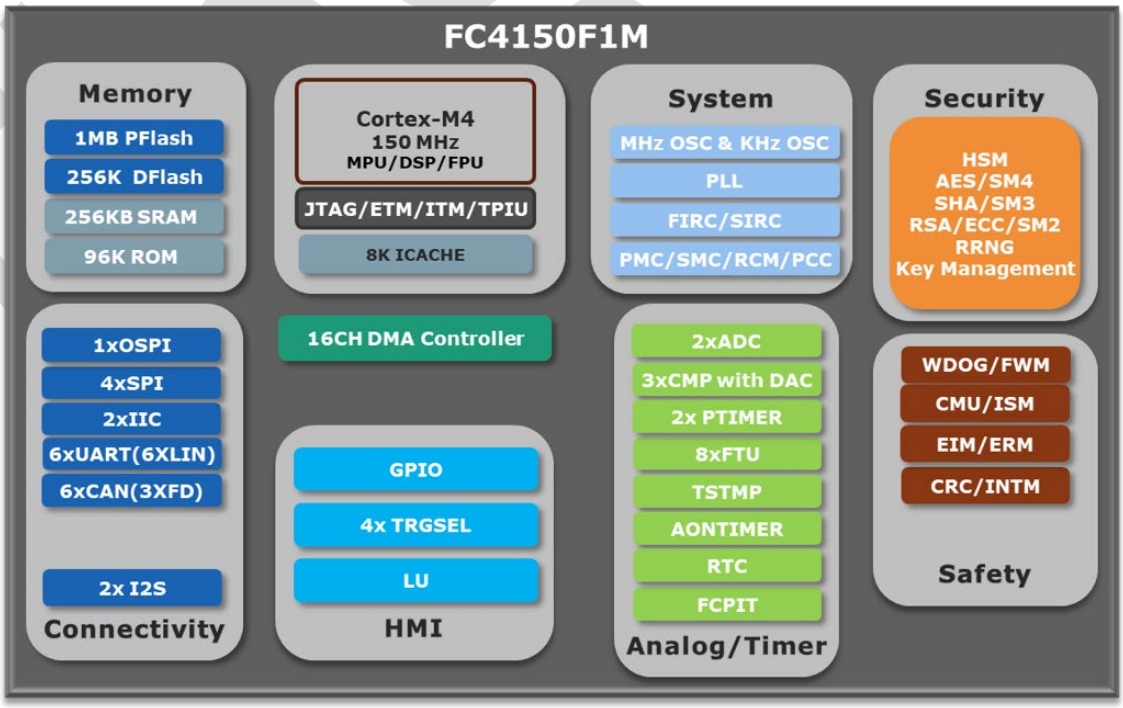


Figure 3. FC4150F1M_B block diagram

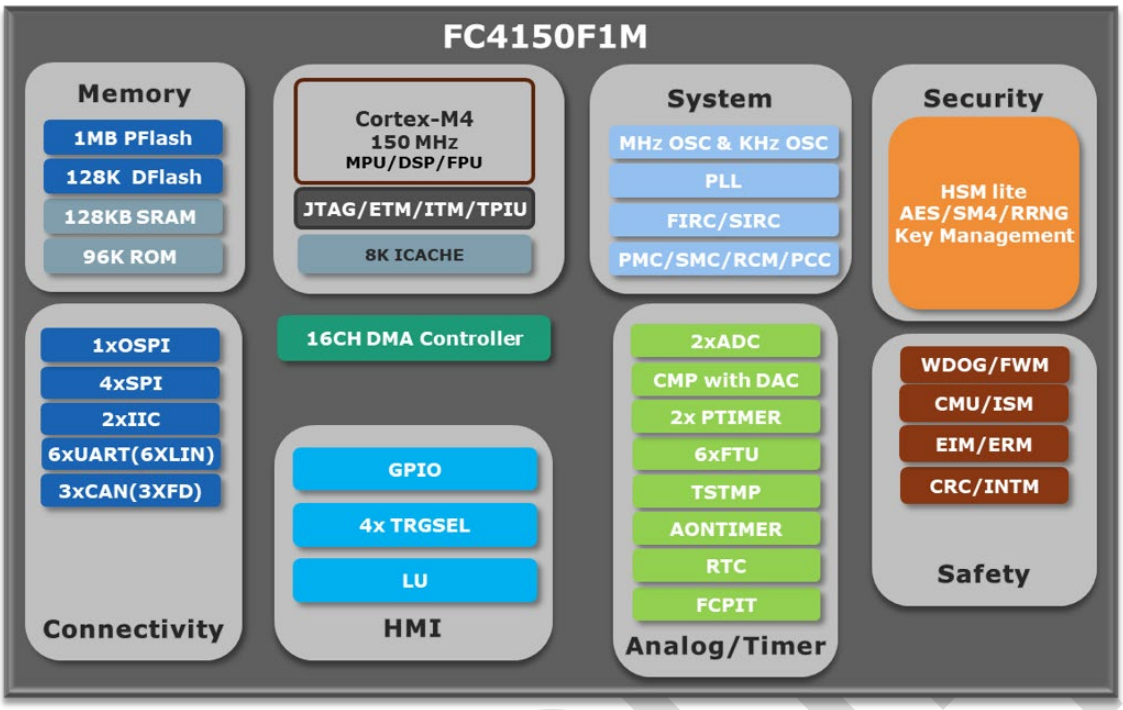
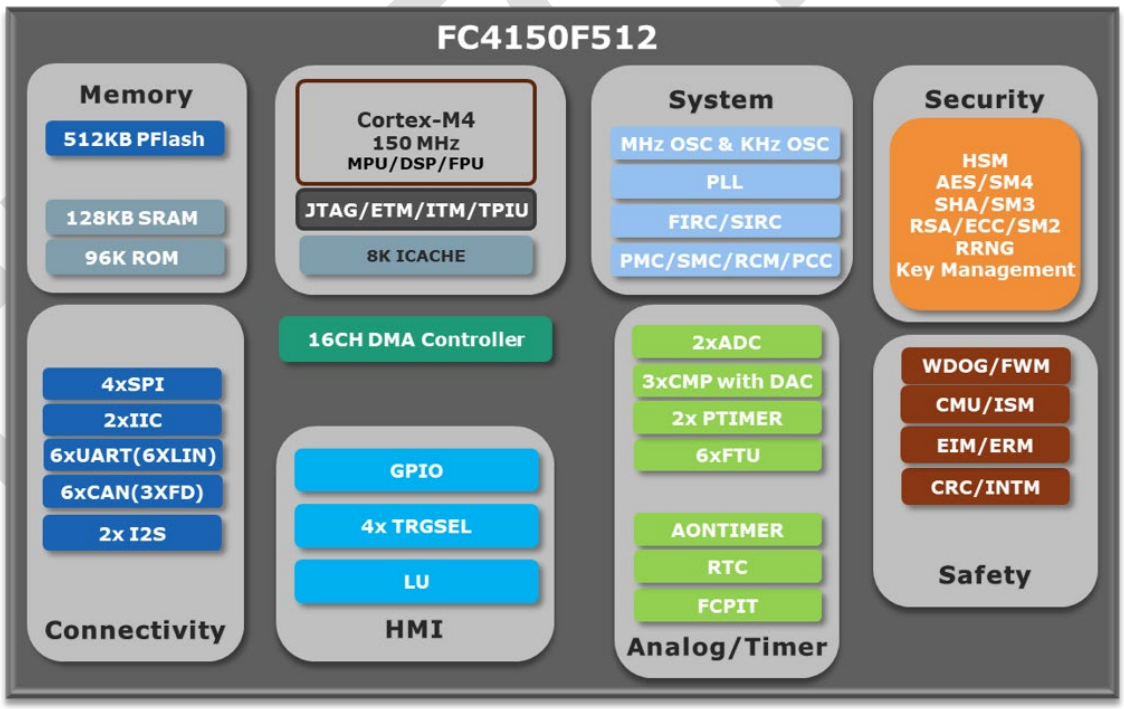


Figure 4. FC4150F512 block diagram



2 Features

The FC4150 product series has the following features:

2.1 Overview

- **Operating Environment**
  - Voltage range: 3.0 V to 5.5 V
  - Ambient temperature (T_A) range: - 40°C to + 125°C; junction temperature (T_J) range: - 40°C to + 150°C
- **Arm Cortex-M4F Core**
  - 150 MHz frequency with 2.66 Dhrystone MIPS per MHz
  - Armv7 Architecture and Thumb-2 ISA
  - Digital Signal Processing (DSP) instruction
  - Single-Precision Floating Point Unit (FPU)
  - Support Memory Protection Unit (MPU) with 8 regions
- **16-channel Direct Memory Access (DMA) with selected DMA source**
- **Clock Sources**
  - 16 ~ 48 MHz Fast Oscillator (FOSC) with up to 50 MHz DC external input clock in bypass mode
  - 32 kHz Slow Oscillator (SOSC)
  - 96 MHz Fast Internal RC Oscillator (FIRC96M)
  - 12 MHz Slow Internal RC Oscillator (SIRC12M)
  - 32 kHz Slow Internal RC Oscillator (SIRC32k)
  - Up to 200 MHz Phased Lock Loop (PLL0) with reference from FIRC48M or FOSC
- **Power Management**
  - Four power modes: RUN, WAIT, STOP and Standby. Optional 64 KB RAM retention in standby mode
- **Memory**
  - Up to 2 MB program flash memory with Error Correction Code (ECC)
  - Up to 256 KB data flash memory with ECC
  - Up to 256 KB SRAM with ECC
  - 8 KB instruction cache for Flash
  - Octal Serial Peripheral Interface (OSPI) with up to 50 MHz DDR support
  - 96 KB ROM with CM4 core self-test/Flash program & erase/ Hardware Secure Module (HSM) APIs
- **Analog**
  - Two 12-bit Successive Approximation (SAR) Analog-to-Digital Converters (ADCs) with up to 32-channel analog inputs per module
  - Up to three Analog Comparators (CMPs) with internal 8-bit Digital-to-Analog Converter (DAC)
- **Debug Functionality**
  - Serial Wire/JTAG Debug Port (SWJ-DP) combines
  - Data Watchpoint and Trace (DWT)
  - Instrumentation Trace Macrocell (ITM)
  - Embedded Trace Macrocell (ETM)
  - Trace Port Interface Unit (TPIU)
  - Flash Patch and Breakpoint (FPB) Unit
  - JTAG Test Access Port (TAP) and boundary scan support

- **Human-Machine Interface (HMI)**
  - Up to 160 GPIO pins with interrupt support
  - Non-maskable Interrupt (NMI)
  - GPIO input/output interface
- **Communications Interfaces**
  - Six FC Universal Asynchronous Receiver/Transmitter (FCUART) modules with LIN support
  - Four FC Serial Peripheral Interface (FCSPI) modules; support 1/2/4 data lines and master/slave mode
  - Two FC Inter-Integrated Circuit (FCIIC) modules
  - Up to six FLEXCAN modules with CAN FD (optional) and PNET support on FLEXCAN0-2
  - Up to one 10/100 Mbps Ethernet with IEEE1588 and AVB (For FC4150F2M only)
  - Up to two Inter-IC Sound (I2S) modules
  - Four Trigger Selects (TRGSELs) for on-chip bus connection
  - One Lookup Unit (LU) module with 4 lookup tables
- **Safety and Security**
  - Hardware Secure Module (HSM) with crypto algorithms including AES/SM4/ECC/RSA/SHA/SM3/SM2/SM9
  - CCM/GCM/ECB/CTR/CBC etc. mode
  - Support random number generation and pseudo random number generation
  - Key import/export management
  - ECC on flash and SRAM memories
  - Memory Access Protection (MAP) on system SRAM
  - Peripheral Access Protection on APB bridge (AFCB
  - One Cyclic Redundancy Check (CRC) module
  - Two Internal Watchdogs (WDOG) with window function
  - One FunSa Watchdog Monitor (FWM) module
  - One Interface Safety Monitor (ISM) module to monitor the critical signals delay/period/duty etc.
  - CM4 core self-test API in ROM code
- **Timers**
  - Up to eight Flexible Timer Unit (FTU) modules with IC/OC/PWM function
  - One Always-on Timer (AONTIMER) with standby wake up capability
  - Two Programmable Timers (PTIMERs)
  - One FC Programmable Interrupt Timer (FCPIT) with 4 channels
  - One Real-Time Clock (RTC)
  - Up to two 56-bit Timer Stamps (TSTMPs) with four 32-bit compare channels. The TSTMP0 runs at 1MHz divided from SIRC12M; and the TSTMP1 runs at Core clock
- **Package**: 100LQFP, 144LQFP and 176LQFP-EP package options
- **Qualification**:
  - ASIL B certified according to ISO 26262
  - AEC-Q100 Grade 1 (-40°C to 125°C)

2.2 Feature Comparison

The table below lists the differences in major features and peripheral counts of four chips from the FC4150 family.

Table 1. FC4150 feature list

Features			Chips			
			FC4150F512	FC4150F2M	FC4150F1M_A	FC4150F1M_B
Automotive cert.	Temp. Grade		Grade1/ -40°C to +125°C			
Function Safety			ASIL B			
Power Design	Voltage Range		3.0V to 5.5V			
	T_A		-40°C to +125°C			
	T_J		-40°C to +150°C			
CPU	Core		Cortex-M4F			
	Frequency		150 MHz			
	MPU		Yes			
	CACHE		8 KB			
	DMA Channels		16			
Memory	PFlash/Bank		512 KB/2	2 MB	1 MB	1 MB/2
	DFlash		Configurable	256 KB		128 KB
	RAM		128 KB	256 KB		128 KB
	ROM		96 KB			128 KB
Clock			Multi clocks, including FIRC96M/SIRC12M/SIRC32K/FOSC48M/SOSC32K/PLL			
Digital IOs			124	160	124	
Peripherals	System	MCM	Yes			
		AFCB	Yes			
		MAP	Yes			
		DMA	Yes			
		WKU	Yes			
		PMC	Yes			
		SMC	Yes			
		RCM	Yes			
		SEC	Yes			
		CORDIC	No			Yes
		SMISC	Yes			
	Memory	FMC	Yes			
		CCU	Yes			
		OSPI	No	Yes		
	Clocking	SCG	Yes			
		PCC	Yes			
	Function Safety	FWM	Yes			
		WDOG	2			
		EIM	Yes			

Features			Chips			
			FC4150F512	FC4150F2M	FC4150F1M_A	FC4150F1M_B
Peripherals	Function Safety	ERM	Yes			
		INTM	Yes			
		CMU	4			
		ISM	Yes			
	Security	CRC	Yes			
	HMI	GPIO	Yes			
		PORT	Yes			
		TRGSEL	4			
		LU	Yes			
	Analog	ADC	2 × 32-ch			2 × 24-ch
		CMP	3			1
	Timer	FTU	6	8		6
		FCPIT	Yes			
		TSTMP	No	1		2
		RTC	Yes			
		AONTIMER	Yes			
		PTIMER	2			
		FREQM	No			Yes
	Comm.	FCSPI	4			
		FCIIC	2			
		FCUART	6			
		FLEXCAN[1]	6			3
		I2S	2			No
		ENET	No	Yes	No	
Security			HSM			HSM-Lite
Package		64LQFP	Yes	No		Yes
		100LQFP	Yes			
		144LQFP	Yes			
		176LQFP-EP	No	Yes	No	

1. Optional CAN FD support for FLEXCAN0/1/2.

Revision History

Revision	Date	Changes
0.1	2023/07/14	Initial release
0.1.1	2023/08/28	Fixed typos
0.1.2	2024/07/16	Added "ABS" to Target Applications

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